# CURRENT COMMENT

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## NOMOGRAM FOR CHLOROFORM

Captain Donald M. Thomas of the USAF at Mitchell Field has designed a nomogram derived from the Copper Kettle.

He has used the standard Foregger 8-ounce Copper Kettle both "as is" and with a small insert holding 45 cc. of chloroform. When using the insert, the remaining space in the Kettle is filled with water at room temperature to help maintain thermostability during vaporization. In either case, checks have shown that the vaporizer produces saturated chloroform vapor and temperature drop during vaporization is very small.

The highly concentrated vapor produced by the Copper Kettle must be diluted with other gases, usually equal parts of nitrous oxide and oxygen, to reach safe anesthetic concentrations. To accomplish this, he uses the nonrebreathing technique of administration.

Captain Thomas believes that in human anesthesia, the chloroform concentration should rarely, if ever, be allowed to exceed 2 per cent, and most patients require only 0.5 to 1.5 per cent for surgical anesthesia. As with other agents of high potency, careful observation of the patient is essential, and one should be guided more by the clinical condition of the patient than by the nomogram in selecting the chloroform concentration. It is a mistake to set up some "safe" concentration of chloroform and let the patient "free wheel."

The accompanying nomogram relates the three variables: total gas flow (nonrebreathing system), oxygen inflow to the Copper Kettle, and resultant final concentration of chloroform. When any two of these are known, a line connecting them will intersect the third scale at the proper point. For example, assume the total flow is 10 l./minute and the vaporizer flow is 200 cc./minute, a chloroform concentration of 0.63 per cent is read on the left hand scale. It should be remembered that the nomogram is drawn for a room temperature of 24 C. (75 F.), and that at lower temperatures there will be some reduction in chloroform concentration.

In constructing the nomogram it was necessary to assume that the diluent effect of the oxygen used for vaporization remains constant. While this is not the case, the accuracy of the nomogram is not seriously impaired as a guide to clinical anesthesia.

He has found that when adequately controlled concentrations of chloroform are used, anesthesia with this agent is quite satisfactory. The disastrous effects on the cardiovascular system so often attributed to chloroform have not been observed.

*Comments by Lucien E. Morris, M.D., University of Washington, Seattle.*—

The opportunity of commenting on Dr. Thomas' Chloroform Nomogram is appreciated, the more so since I have for a number of years resisted and discouraged the publication of nomograms for use with liquid anesthetics vaporized in the Copper Kettle. My objections have been based in part on the knowledge that unfamiliarity with the performance characteristics of this type of vaporizer has on many occasions had the sequelae of overdosage and cardiac arrest. Also, since there is a wide variation between patients in the concentration of vapor required in the various anesthetic systems to produce a desired level of anesthesia, it seems to me obviously unwise to adopt a cookbook approach in the use of a Nomogram to determine and provide a preconceived concentration of vapor. As Dr. Thomas has carefully pointed out the anesthetist must ". . . be guided more by the clinical condition of the patient than by the nomogram" in selecting and maintaining safe concentrations.

On the other hand in defense of the Nomogram it is sometimes useful to know where one has been and the concentrations

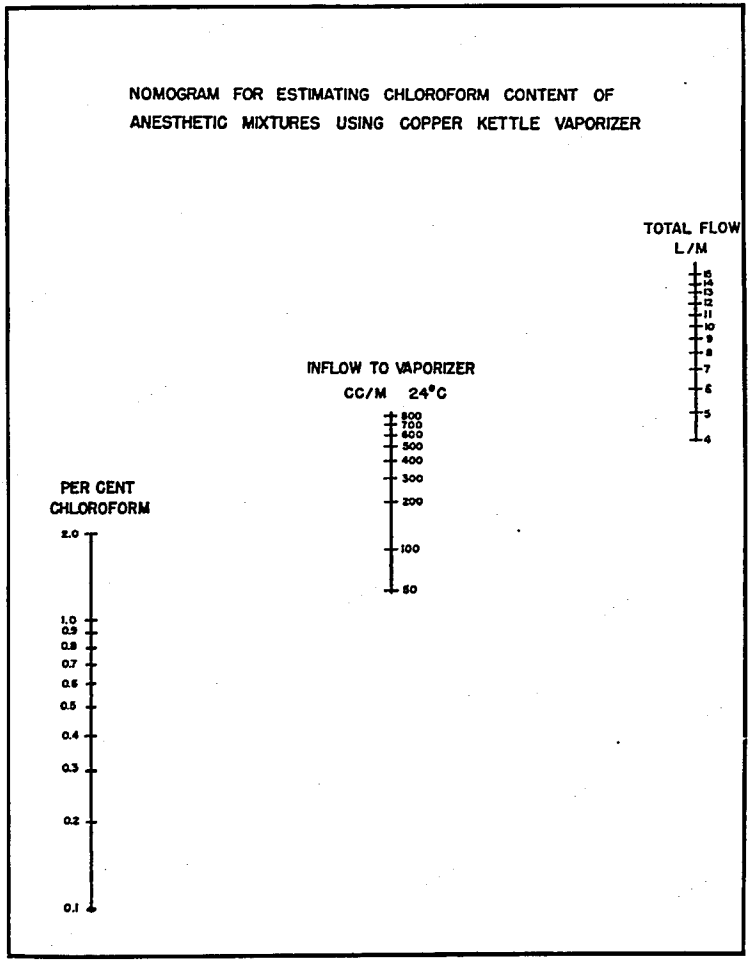



FIG. 1

used under various circumstances. However, this can be easily calculated from the vapor pressure curve of the particular anesthetic agent if one knows the temperature of the liquid, the volume of carrier gas, and volume of diluent.

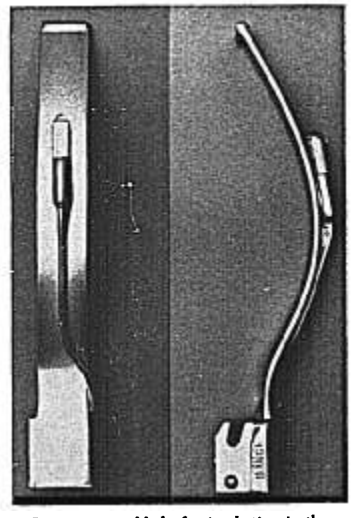
It is encouraging to me to learn that chloroform is being used in the Copper Kettle by others than ourselves. I continue to believe that chloroform is a most useful agent which has been inordinately maligned. Chloroform is without doubt the most potent inhalation agent yet available as measured either by the volume percentage of vapor required for anesthesia or by the extremely small increments in concentration which produce changes in depth. It was the recognition of the need of a means which would allow minute changes in and discrete control over chloroform vapor concentration that eleven years ago first stimulated me to build the piece of laboratory equipment which was the original prototype of the Copper Kettle.

The basic principles incorporated in the Copper Kettle vaporizers design allow an efficient performance with all liquid anesthetic agents, *i.e.*, the carrier gas-vapor mixture at the outflow of the vaporizer is a saturated vapor at the temperature of the gas-liquid interface (which is the vaporizing surface), even at carrier gas flows up to several liters per minute. Users of such a vaporizer who wish to calculate the concentration of an agent from its known saturated vapor pressure curve must not fail to remember that the vapor itself takes up space, providing a larger volume of outflow from the vaporizer than the measured volume of carrier gas inflow. For example, a measured inflow of 300 cc. of carrier gas per minute will at 24 C. pick up approximately 100 cc. of chloroform vapor thus producing an outflow from the vaporizer of 400 cc. of 25 per cent chloroform vapor, while with ether at 24 C. 300 cc. will pick up over 600 cc. of vapor giving a total outflow of approximately 900 cc. of 68 per cent ether vapor. In either case it would then be necessary to dilute the flow from the vaporizer fifty times in order to provide a reasonable maintenance concentration.

## GADGETS

### Blade for Lateral Intubation

Dr. Clifton Dance, Jr., of Ft. Lauderdale, Florida, advocates intubation in the lateral position (in chest and kidney cases), for the following reasons: to avoid hypotension during change of position of anesthetized patient; to decrease anesthesia time; to provide opportunity to obtain baseline preanesthetic assessment of patient's tolerance of lateral position (plus kidney lift and acute lateral flexion); to minimize need for assistance from operating room personnel in placing patient; to minimize low back strain in personnel; to facilitate checking pressure points to avoid neuropathies; to minimize displacement of intravenous needles; to determine electrocardiographic alterations coincident with changes in position; to be able to defer or avoid intubation in patients with satisfactory airway after trial of position and anesthesia.



Laryngoscope blade for intubation in the lateral position.

He improvised the illustrated laryngoscope blade as an aid to intubation in the lateral position. No wall is present, thereby making a lateral approach with the tube to the glottis possible from either side (in contrast to the conventional Macintosh where the wall makes an approach from the left side quite difficult). The light is centered in the midline so that it will not be encroached upon by soft tissues abutting the edge of the blade in either lateral